Flexible multifunctional Structural Health Monitoring systems, Phase I Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)

ABSTRACT

Composite materials are being used in an increasing number of NASA?s space habitat structures because they are lightweight but very strong. The materials can enhance the operation and performance of the structures, they can also introduce significant inspection challenges that push the limits of traditional nondestructive evaluation (NDE) in terms of time and cost. Using built-in sensors for Structural Health Monitoring (SHM) can help overcome inspection difficulties, and can also enable real-time monitoring from cradle-to-grave. Currently however, there are no long duration flexible hybrid multifunctional sensors that can be conformably distributed over very large flexible surfaces and thereby enable their availability of instantaneous information on the structural integrity of expandable space habitats made of composites or other hybrid materials, and measure environmental conditions for optimum performance while adding minimal weight. This program will therefore focus on development, maturation, assembly and automation of Flexible multifunctional Structural Health Monitoring systems? on non-traditional conformal, bendable, and stretchable substrates for use in space. The program will enable the low-cost manufacturing of large area sensors that can be integrated into large flexible substrates for space habitat. Phase I will focus on demonstrating the feasibility of the approach using a space habitat material.

ANTICIPATED BENEFITS

To NASA funded missions:

Potential NASA Commercial Applications: The proposed system has several critical future exploration applications including support of platform technologies for self-assembly, in-space assembly, in-space maintenance & servicing, and high-energy space platforms such as highly reliable autonomous deep-space systems. These technologies have the potential of significantly increasing safety, reliability, affordability, and effectiveness of

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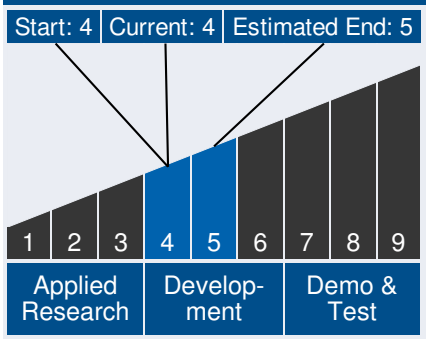
Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Program Manager:

- Carlos Torrez

Continued on following page.

NASA missions. One of the major applications would be in future space habitats where health monitoring is of major concern because of the costs and risks associated with each mission failure. These habitats can now be built by taking advantage of new, lightweight proven structural material design. By keeping down empty weight and operations and maintenance costs and personnel requirements, and emphasizing reusability and save-ability these habitats will greatly decrease space mission costs.

To the commercial space industry:

Potential Non-NASA Commercial Applications: Acellent Technologies is currently working towards a path breaking technology that will have a potential impact on future structural health monitoring applications. The outreach of this technology will be vast in the composites world ranging from in-service airborne, ground, and sea-based vehicles to space, and weapons system platforms that require some form of inspection and maintenance procedures to monitor their integrity and health condition, to insure the safety of mission personnel, to prolong flight vehicle life span, or to prevent catastrophic failures. Composite materials are increasingly being used in the aerospace, automotive, and ship industries for performance reasons, competitive pressures drive the need for reductions in manufacturing costs and associated improvements in fabrication reliability. The easy integration and plug-and-play aspects of the system will make it ready to use with any type of structure

Management Team *(cont.)*

Principal Investigator:

- Jeffrey Bergman

Technology Areas

Primary Technology Area:
Materials, Structures, Mechanical Systems and Manufacturing (TA 12)

- Structures (TA 12.2)
  - Reliability and Sustainment (TA 12.2.3)

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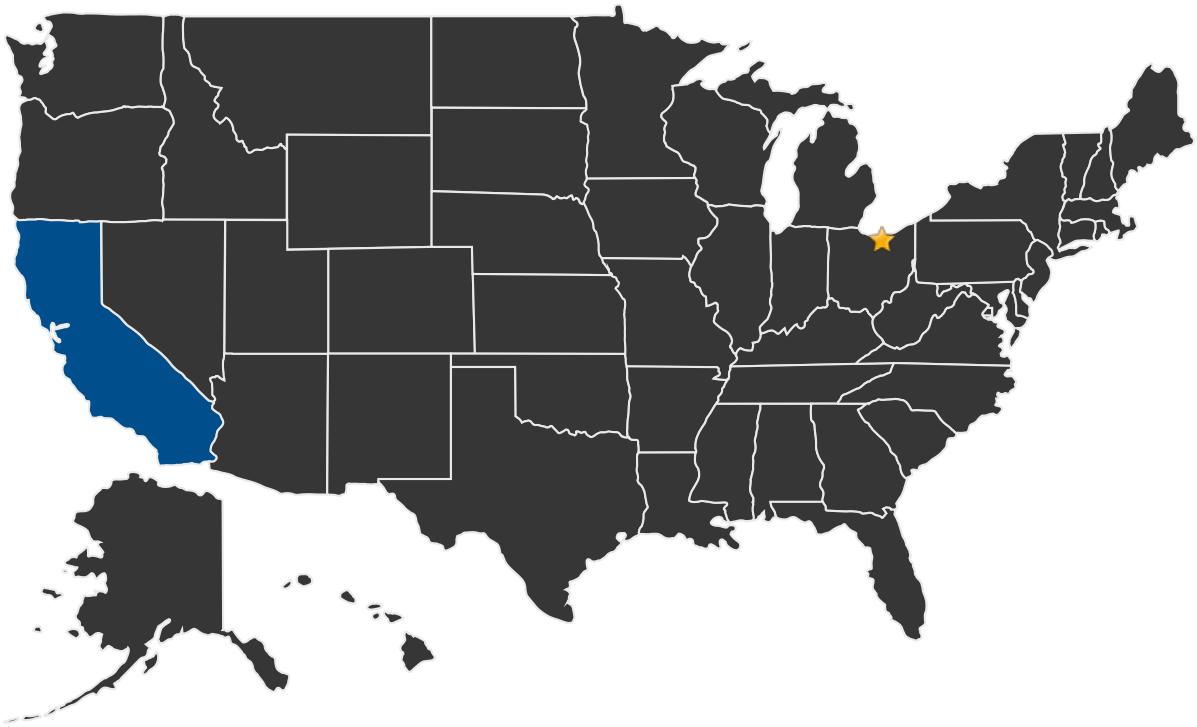
U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center:
Glenn Research Center

Other Organizations Performing Work:

- Acellent Technologies, Inc. (Sunnyvale, CA)

PROJECT LIBRARY

Presentations

- Briefing Chart
  - (http://techport.nasa.gov:80/file/23122)

IMAGE GALLERY

Flexible multifunctional Structural Health Monitoring systems, Phase I

DETAILS FOR TECHNOLOGY 1

Technology Title

Flexible multifunctional Structural Health Monitoring systems, Phase I

Potential Applications

The proposed system has several critical future exploration applications including support of platform technologies for self-assembly, in-space assembly, in-space maintenance & servicing, and high-energy space platforms such as highly reliable autonomous deep-space systems. These technologies have the potential of significantly increasing safety, reliability, affordability, and effectiveness of NASA missions. One of the major applications would be in future space habitats where health monitoring is of major concern because of the costs and risks associated with each mission failure. These habitats can now be built by taking advantage of new, lightweight proven structural material design. By keeping down empty weight and operations and maintenance costs and personnel requirements, and emphasizing reusability and save-ability these habitats will greatly decrease space mission costs.